Algebra I Notes

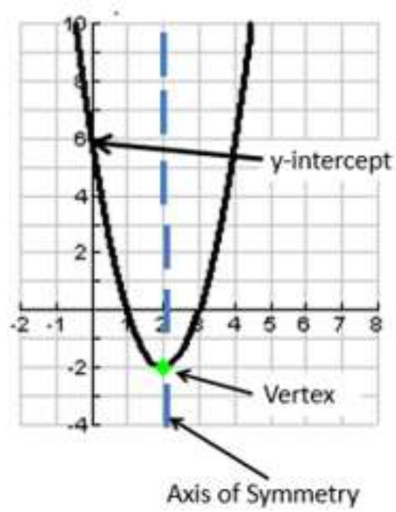
9.1 Quadratic Graphs and Their Properties

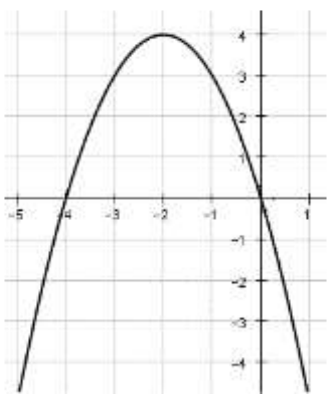
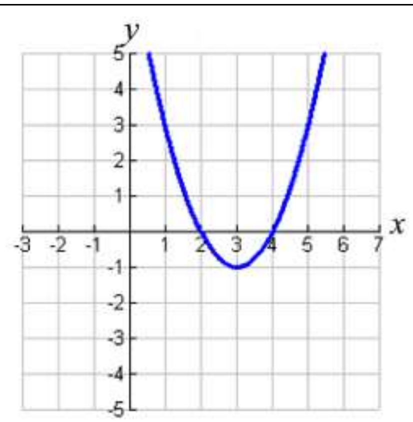
Objective: To graph quadratic functions in the form $y = ax^2 and\ y = ax^2 + c$

PARABOLA – the "U" shaped graph of a quadratic function

Standard Equation: $y = ax^2 + bx + c$

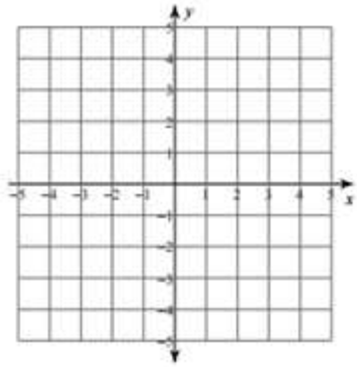
- If a > 0 → parabola opens up (min)
  If a < 0 → parabola opens down (max)
- Vertex $(-\frac{b}{2a}$, y) - the point where the parabola changes direction
- Axis of Symmetry- $(x = -\frac{b}{2a})$ the vertical line through the vertex that cuts the parabola in half
- Y-intercept (c) – where the parabola crosses the y-axis



	**Vertex:**__________ **Max/Min:**__________ **Axis of Symmetry:**__________ **Domain:**__________ **Range:** __________
	**Vertex:**__________ **Max/Min:**__________ **Axis of Symmetry:**__________ **Domain:**__________ **Range:** __________

Example 1 Graph $y = x^2$. This is referred to as the "parent graph."

x	$y = x^2$	y



Vertex:____________________

Max/Min:__________________

Axis of Symmetry:___________

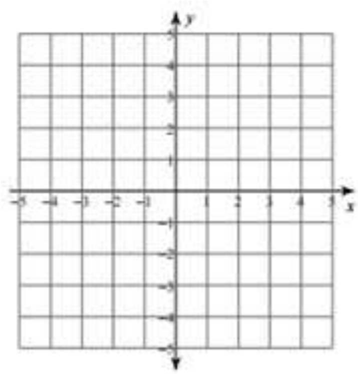
Width:_____________________

Domain:___________________

Range: ____________________

Example 2 Graph $y = \frac{1}{4}x^2$. How do you think this graph compares to the parent graph?

x	$y = \frac{1}{4}x^2$	y



Vertex:____________________

Max/Min:__________________

Axis of Symmetry:___________

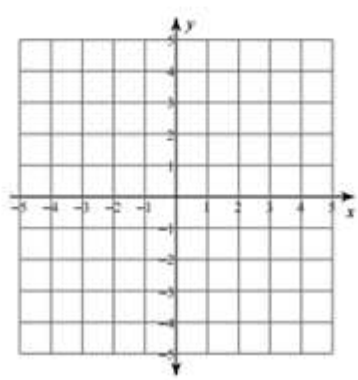
Width:_____________________

Domain:___________________

Range: ____________________

Example 3 Graph $y = -2x^2$. How do you think this graph compares to the parent graph?

x	$y = -2x^2$	y



Vertex:____________________

Max/Min:__________________

Axis of Symmetry:___________

Width:_____________________

Domain:___________________

Range: ____________________

<u>Example 4</u> Order each set of functions from the widest to the narrowest function.

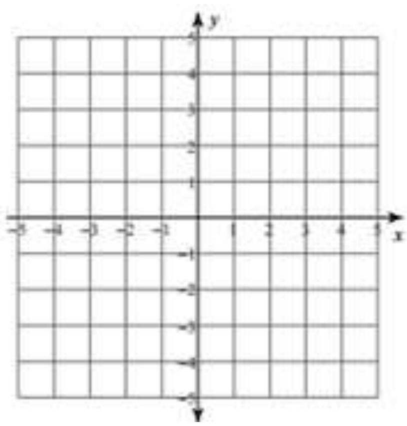
a) $y = -3x^2,\ y = \ -5x^2,\ y = -x^2$

b) $y = \frac{1}{6}x^2,\ y = \frac{1}{4}x^2,\ y = \frac{1}{2}x^2$

<u>Example 5</u> Graph each function of the form $y = ax^2 + c$

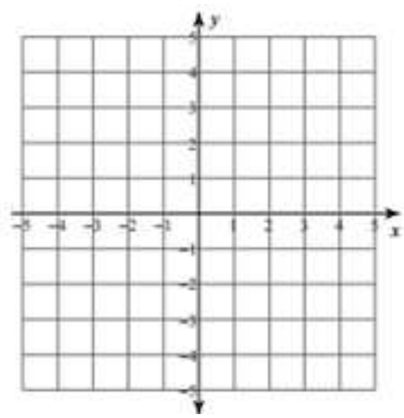
a) $y = x^2 - 3$

x	$\mathbf{y = x^2 - 3}$	y



b) $y = -\frac{1}{2}x^2 + 3$

x	$\mathbf{y = -\frac{1}{2}x^2 + 3}$	y

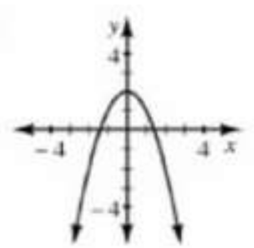


How does the "a" value affect the graph?

How does the "c" value affect the graph?

<u>Example 6</u> **Match each function with its graph.**

A. $y = -x^2 + 2$ **B.** $y = -x^2 - 2$ **C.** $y = x^2 - 2$

<table>
<tr><td>
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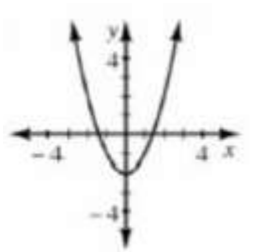
<tr><td>
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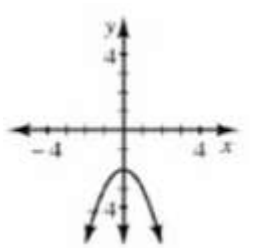
<tr><td>
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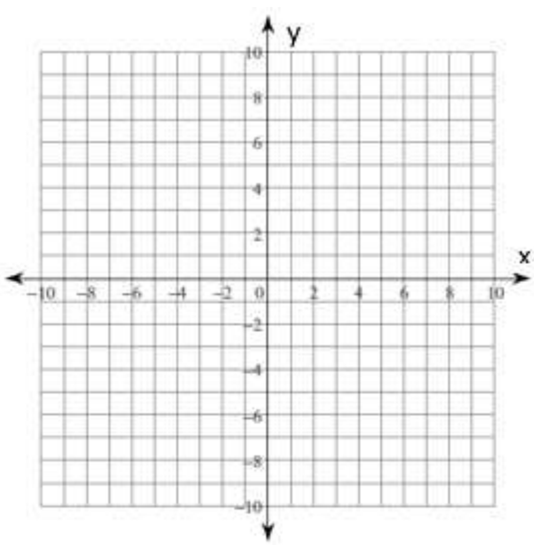
Algebra I

9.2 Quadratic Functions

Objective: To graph quadratic functions in the form $y = ax^2 + bx + c$

<u>WARM-UP</u> **Graph $y = -2x^2 + 4x$** **a=__________ b=__________c =__________**

x	$y = -2x^2 + 4x$	y



Vertex:

Open up/down:

Max/Min:

Axis of Symmetry*:

Domain:

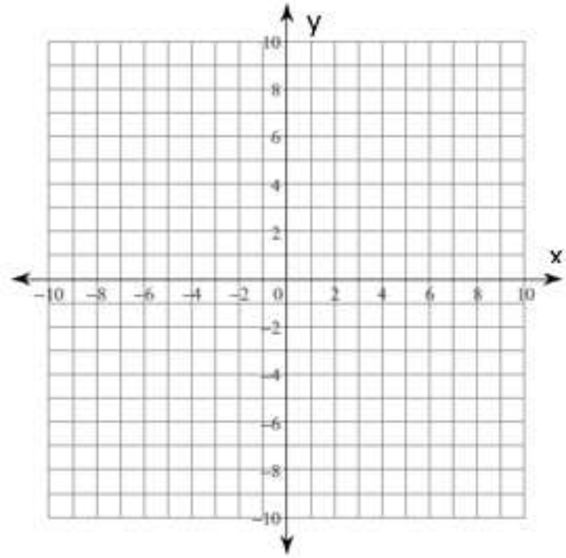
Range:

<u>NOTE:</u> The axis of symmetry is in the equation $y = ax^2 + bx + c$ is:______________________

<u>Example 1</u> **Graph $y = x^2 - 6x + 4$ without using a table.**

a= __________, b= ____________, c = ____________

Axis of Symmetry:



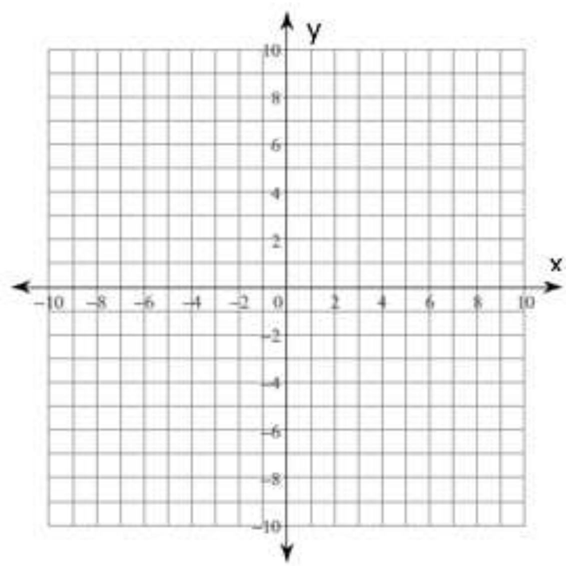
Vertex:

y-intercept:

<u>Example 2</u> **Graph $y = -x^2 + 2x - 5$ without using a table.**

a= __________, b= ____________, c = ____________

Axis of Symmetry:



Vertex:

y-intercept:

Example 3

A baseball player hit a ball with an upward velocity of 64 feet/sec. Its height h in feet after t seconds is given by the function $h(t) = -16t^2 + 64t + 6$.

a. What is the maximum height the ball reaches?

b. How long will it take the baseball to reach the maximum height?

c. How long does it take for the ball to hit the ground?

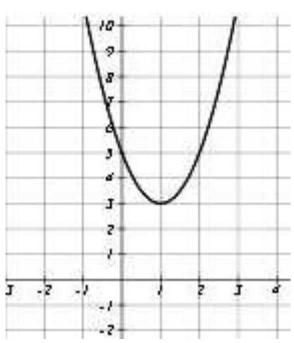
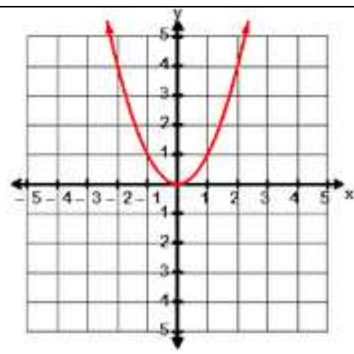
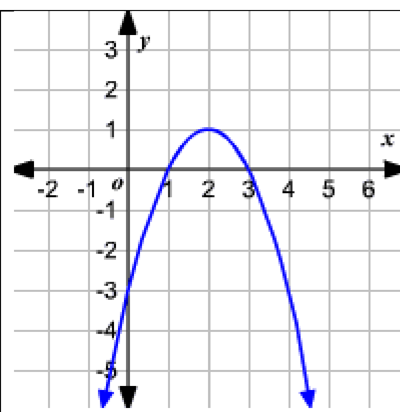
Algebra I

9.3 Solving Quadratic Equations

Objective: To solve quadratic equations by graphing and using square roots

KEY CONCEPT
The quadratic equation $ax^2 + bx + c = 0$ can have ______________________ real solutions.
These solutions are called ____________________ or ________________ or ________________.
The solutions are also the ________________________________ of the graph.

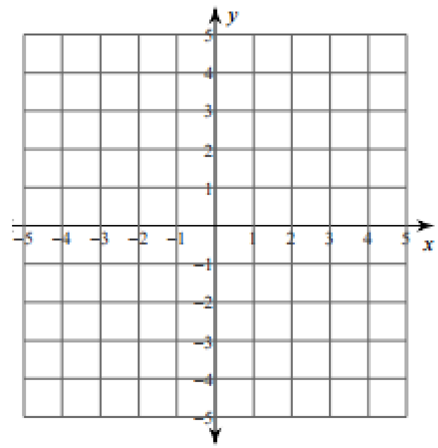
Example 1 For each graph name the solution(s).

		
# OF SOLUTIONS:	**# OF SOLUTIONS:**	**# OF SOLUTIONS:**
SOLUTIONS:	**SOLUTIONS:**	**SOLUTIONS:**

Example 2 Solve each equation by ***GRAPHING*** the function.

$x^2 - 1 = 0$ a = ___, b = _____, c = ____

Axis of Symmetry:



Vertex:

y-intercept:

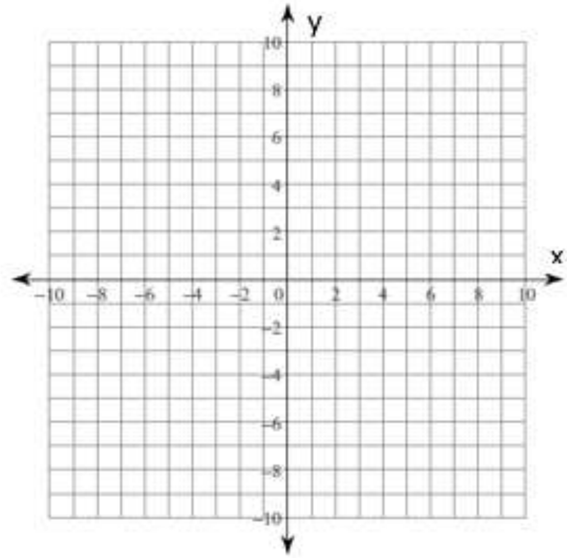
SOLUTION: ____________________

Find another point:

Example 3 Solve each equation by *GRAPHING* the function.

$2x^2 - 8 = 0$ a = ________, b = _______, c =__________

Axis of Symmetry:



Vertex:

y-intercept:

SOLUTION: ________________________

Find another point:

LIST THE PERFECT SQUARES:

Review of Reducing Square Roots:

1. $\sqrt{32}$
2. $\sqrt{75}$
3. $\sqrt{68}$
4. $\sqrt{405}$

Example 3 **Solve each equation by finding *SQUARE ROOTS*.**

a) $x^2 = 36$

b) $5p^2 - 45 = 0$

c) $9m^2 - 25 = 0$

d) $3n^2 + 12 = 0$

e) $72 - 9n^2 = 0$

f) Find the length of a square with area 72 m^2.

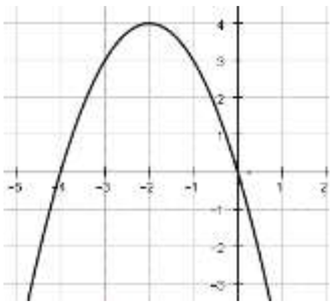
Algebra I Notes

9.4 Solving Quadratic Equations

Objective: To solve quadratic equations by factoring.

Warm-Up

a.



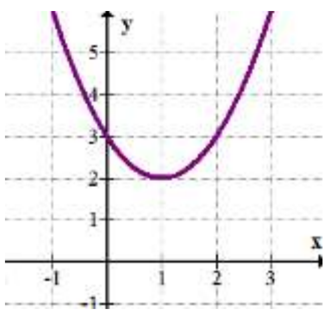
Axis of Symmetry: ______________________

Vertex: ______________________

# of Solutions: ______________________

Solutions: ______________________

b.



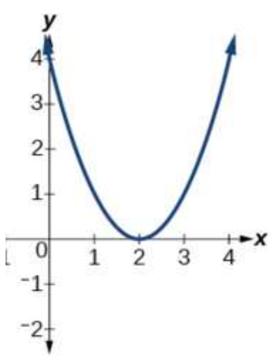
Axis of Symmetry: ______________________

Vertex: ______________________

# of Solutions: ______________________

Solutions: ______________________

c.



Axis of Symmetry: ______________________

Vertex: ______________________

# of Solutions: ______________________

Solutions: ______________________

d. Solve $2x^2 - 50 = 0$

ZERO PRODUCT PROPERTY

For any real numbers a and b, if $a \cdot b = 0$, then $a = 0$ *or* $b = 0$.

Example 1 Use the Zero-Product Property to solve each equation.

a. $(4x + 5)(x - 3) = 0$

b. $5n\,(n + 2) = 0$

#1 RULE OF FACTORING: ______________________________

Example 2 Solve each by factoring.

a. $x^2 + 4x - 32 = 0$

b. $m^2 - 4m = 21$

Example 3 Solve each by factoring.

a. $x^3 - 10x^2 + 24x = 0$

b. $3a^2 + 33a = -30$

Example 4 Solve each by factoring.

a. $3x^2 + 4x - 15 = 0$

b. $2n^2 = 13n + 7$

c. $4m^2 - 8m = -3$

d. $8p^2 - 14p + 3 = 0$

<u>Example 5</u> Application Problem

The area of a rectangular garden is 350 ft^2. The length of the garden is 11 feet longer than the width. What are the dimensions of the garden?

Algebra I

9.6 The Quadratic Formula and the Discriminant

Objective: To solve quadratic equations using the quadratic formula.
To find the number of solutions of a quadratic equation.

Warm-Up **Solve by factoring.**

1) $(4x+5)(x-3)=0$

2) $3m^2+m=14$

take note

Key Concept Quadratic Formula

Algebra

If $ax^2 + bx + c = 0$, and $a \neq 0$, then

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Example

Suppose $2x^2 + 3x - 5 = 0$. Then $a = 2$, $b = 3$, and $c = -5$. Therefore

$$x = \frac{-(3) \pm \sqrt{(3)^2 - 4(2)(-5)}}{2(2)}$$

Discriminant's Value	# and Nature of Solutions	Possible Graph

Solve using the Quadratic Formula.
Find the discriminant, determine the nature of the roots, solve.

<table>
<tr>
<td>1) $2x^2 - 6x + 4 = 0$

a = __________, b = _________, c = _________

Discriminant's Value:

#/Nature of Roots:

Solution:</td>
<td>2) $6m^2 + m + 12 = 0$

a = __________, b = _________, c = _________

Discriminant's Value:

#/Nature of Roots:

Solution:</td>
</tr>
</table>

Solve using the Quadratic Formula.
Find the discriminant, determine the nature of the roots, solve.

3) $3y^2 + 10y = 5$ a = __________, b = _________, c = _________ Discriminant's Value: #/Nature of Roots: Solution:	4) $2p^2 = 28p - 98$ a = __________, b = _________, c = _________ Discriminant's Value: #/Nature of Roots: Solution:

Application Problem

Example 5 A ball is thrown up into the air and its height is represented by the equation $h = -d^2 + 10d + 5$. How far away does the ball land on the ground?

Choosing the Best Method for Solving a Quadratic Equation:

Method	When to Use
Graphing	Use if you have a graphing calculator handy.
Square roots	Use if the equation has no x-term.
Factoring	Use if you can factor the equation easily.
Completing the square	Use if the coefficient of x^2 is 1, but you cannot easily factor the equation.
Quadratic formula	Use if the equation cannot be factored easily or at all.

Example 6 Which method(s) would you choose to solve each equation? Justify your reasoning.

a) $h^2 + 4h + 7 = 0$

b) $a^2 - 4a - 12 = 0$

c) $a^2 - 144 = 0$

d) $24m^2 - 11m - 14 = 0$

Algebra I Name________________________________

CHAPTER 9 REVIEW

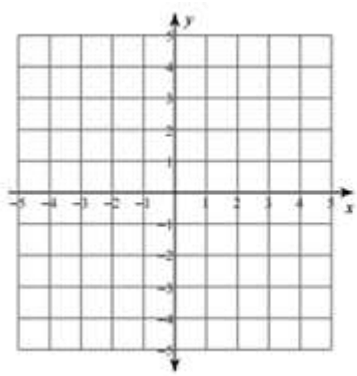
Write the Quadratic Equation: ____

How does the "a" value affect the graph?________________________________

How does the "c" value affect the graph?________________________________

Example 1 Graph the quadratic equation $y = x^2 - 4$

x	$y = x^2 - 4$	y
-2		
-1		
0		
1		
2		



Vertex:____________________

Max/Min:________________

Axis of Symmetry:__________

Width:____________________

Domain:__________________

Range: ___________________

Example 2 Consider the quadratic equations and label by width.

a. $y = \frac{1}{4}x^2,\ y = \frac{1}{10}x^2$

Wider graph:__________________

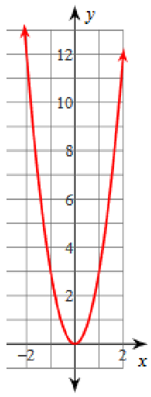
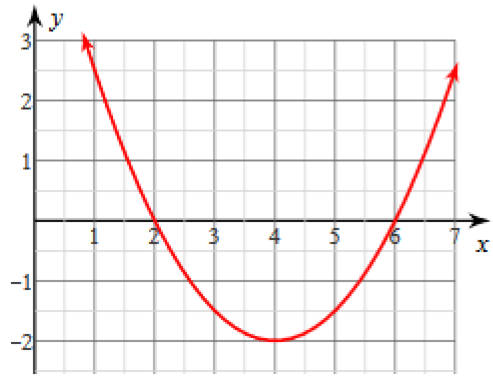
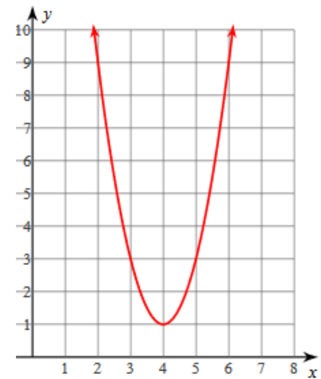
Narrower graph:_______________

b. $y = -5x^2,\ y = -2x^2$

Wider graph:__________________

Narrower graph:_______________

Example 3 State the ***number and nature of the roots*** and ***state the solution*** for each.

Graph			
Number of solutions			
Solution			

The ***four*** methods we discussed to solve a quadratic equation include:

1.

2.

3.

4.

Example 4 Solve by using square roots.

a. $x^2 = 49$

b. $4n^2 - 12 = 0$

c. $-5p^2 + 20 = 0$

Example 5 Solve by factoring.

a. $a^2 - 2a = 24$

b. $2x^2 + 5x = 3$

Example 6 State the quadratic formula:____________________________________

State the discriminant:____

Example 7 State the number and nature of the solution.

a. $b^2 - 4ac > 0$ ____

b. $b^2 - 4ac = 0$ ____

c. $b^2 - 4ac < 0$ ____

Example 8 Solve $x^2 - 8x = -12$ using the quadratic formula.

a = __________, b = _________, c = _________

Discriminant's Value:

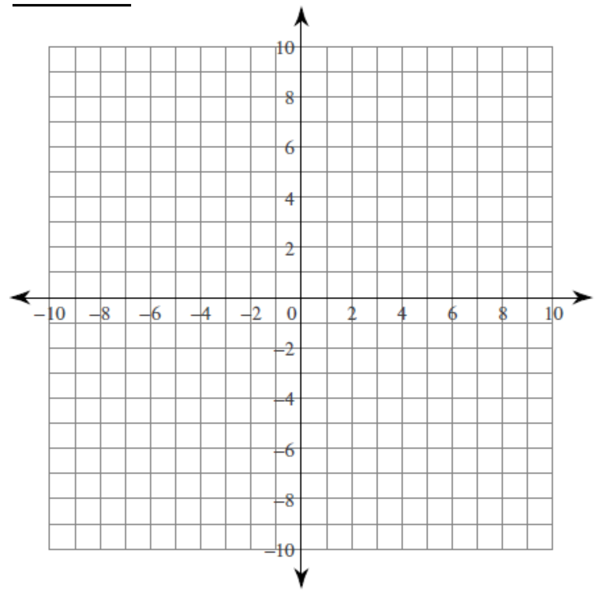
Solution:

#/Nature of Roots:

Example 9 Consider the equation $y = x^2 + 6x + 8$.

a. Solve by ***graphing***. a= _________, b= _________, c = ________

Axis of Symmetry:



Vertex:

y-intercept:

Solution:________________________

b. Solve by ***factoring*.**

c. Solve by the ***quadratic formula.***